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Supply chain management six sigma: a management innovation methodology at the Samsung Group

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Abstract
Purpose – This paper seeks to introduce a six-sigma based methodology for the SCM domain which was developed and has been used in Samsung.
Design/methodology/approach – The paper provides a detailed description of how and why a six-sigma-based methodology for the SCM domain was developed in Samsung and presents a real industry case to illustrate the usage of the methodology.
Findings – In Samsung, the effort and investment in synthesizing SCM and six sigma, and developing a unique six-sigma-based methodology to improve its SCM operation, have turned out to be fruitful. The Black Belt program has produced highly qualified and talented SCM specialists, who are currently training the methodology to members in their organizations and leading SCM projects. SCM projects are being prepared and conducted in a more disciplined way and their outcomes are continuously monitored and shared through the company's repository.
Research limitations/implications – To generalize its usefulness, the methodology needs to be applied to the SCM projects of those companies whose organizational and cultural contexts are different from those of Samsung. In addition, the overview of an illustrative SCM project presented in the paper is brief due to space limitations.
Practical implications – Today, SCM is increasingly recognized as a strategic way to innovate a company's business operation. This paper shows that a methodology such as Samsung's SCM six sigma can be the key to conducting SCM projects in a more disciplined way and for fruitful outcomes.
Originality/value – The paper introduces a unique six-sigma-based methodology for the SCM domain which has been developed and applied in a leading global manufacturing, financial, and services conglomerate. This methodology could be adapted by other companies for their SCM projects to increase the likelihood of project success.

Keywords Six sigma, Supply Chain management, Project management

Paper type Case study

1. Introduction

In its early years, supply chain management (SCM) was narrowly conceived as a new approach to inventory management or operating cost reduction. In the 1990s organizations and some specific industry segments began to recognize the much greater roles and impact of SCM on their business operations. SCM is increasingly recognized as a strategic way to innovate a company's entire business operation as well as its planning and execution. This article reports Samsung's journey in developing a systematic SCM methodology using six sigma and applying it to SCM projects and related activities.

The article first presents the background of introducing a six-sigma based methodology for the SCM domain in Samsung. The next section describes a detailed overview of the Samsung SCM six sigma methodology, which has been used for the last two years. A summary of a six sigma supply chain project is then presented and in the final section we draw some conclusions.

2. Background

2.1 Company overview and the role of SCM and six sigma

The Samsung Group of companies is recognized as a leading global manufacturing, financial, and services conglomerate. It was founded in 1938 and focused its businesses on areas such as textiles, shipbuilding, machinery, and chemicals. Since the 1980s, the group has made enormous efforts and investment in the electronics and semiconductor industry. As a result, the Samsung Group has experienced a dramatic growth in net

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profits since the 1990s. The flagship unit, Samsung Electronics Company (SEC), was one of only two manufacturing companies worldwide to post profits of more than $10bn in 2004 (Toyota Motors being the other). Samsung was ranked twentieth in global brand value, according to a report by Interbrand (2006). Many regard these successes as reflecting a continuous and relentless effort at Samsung to improve the way it conducts business. For the last few years, SCM and six sigma have been two pillars of business innovation at Samsung.

The Samsung Group of companies has large, complex, global supply chains in most of the products it manufactures and makes extensive use of SCM solutions and process innovations to support and improve its operations. Most notably, at SEC, advanced planning and scheduling (APS) systems have been adopted since the 1990s and have brought the company many successes in terms of operational excellence. Recently, Samsung Electronics was ranked seventh in a respected analyst's ranking of the global top 25 companies in supply chain excellence (AMR, 2005).

Six sigma has been a key enabler for the group's success. The Chairman of the Group proclaimed the adoption of a business innovation approach called "new management" (pronounced in Korean as *shin kyung young*) in 1993. "New management" is the pursuit of quality-oriented management in business operations as well as in manufacturing. Along with the "quality movement" in industry, new management evolved from initial product quality assurance but later shifted its focus to include the quality of the entire business process, which is the rationale behind six sigma. The outcomes were high-quality, innovative product developments, and consequently an increase in customer satisfaction and profits, and are well demonstrated by many of the world's best technological resources, including DRAM, SRAM, TFT-LCD, digital TV, and Flash memory, to name but a few.

2.2 Why SCM + six sigma?

Despite the extensive use of SCM solutions and process innovation to improve global business operation, in 2004 the company still felt that its supply chain operations had significant room for improvement. In the early 1990s, the Group's senior management decided to capitalize on the potential synergy between SCM and six sigma, which they believed were based on four key areas:

1 *Project discipline* – Six sigma uses a structured process of *d*efining, *m*easuring, *a*nalyzing, *i*mproving, and *c*ontrolling (DMAIC) products or processes, which provides the discipline to deal with operational vulnerabilities and variability in business operation (Hammer, 2002). Six sigma would enforce a more disciplined approach to SCM projects and ensure that SCM projects were defined rigorously and executed methodically. Also six sigma's analytical emphasis would steer the improvement projects to investigating and resolving root causes, rather than mere symptoms of SCM problems at Samsung.
2 *Sustaining results* – One of the key challenges of SCM is sustaining the results of a successful project after completion. Too often, as project groups move on to future projects, the past process improvement successes become just that – "past" successes – rather than a sustained base of improvement on which to build further. However, the link between planning and execution through feedback (also known as closed-loop) has been an important issue in SCM in general and manufacturing planning and control system in particular (Vollmann *et al.*, 1997). Six sigma complements this need through the "control" stage in a DMAIC methodology or "verify" stage in a DMADOV methodology. Therefore, six sigma supplemented by a Samsung's own centralized system of capturing and tracking all of its projects beyond their completion ensures that improvements be sustained.
3 *Well-established HR framework* – At Samsung, a key area for the potential improvement of SCM activities centered on people. The company continually faces a shortage of trained, qualified, and talented people to harness the maximum potential that its systems and processes offered. Consequently, SCM solutions were not being fully utilized and the innovative processes could not be wholeheartedly adopted. The shortage of SCM talent decreased the potential for return on investment that the system and process innovations could bring to the company. Six sigma was seen as a proven framework for developing people. Its colored belt system clearly delineated levels of competency and thus helped manage people in a differentiated way from the HR perspective. Six sigma was already prevalent in Samsung as a management innovation methodology with programs and structures in place. Leveraging the belt system with SCM expertise was a way to keep track of and continue to develop SCM talent within the Group.
4 *Quantitative strength* – Six sigma was seen as a methodology which would, by its nature, drive a heightened usage of quantitative analysis (Breyfogle, 1999). Quantitative data about operational activities and performance was abundant, but not used sufficiently for problem solving or decision-making. Appropriate usage of numerical data was expected to uncover flaws in SCM processes and further enhance the quality of SCM decisions made at Samsung.

Based on the above rationale, the company put together a methodology to formally combine SCM and six sigma, by training and developing supply chain staff to be more capable of leading SCM innovations. Over the last two years of implementation, SCM six sigma has become a unique and useful component of Samsung's strategy for systematic and continuous improvement of its SCM activities.

3. Samsung SCM six sigma

Samsung SCM six sigma comprises two building blocks. The first block is a core methodology that was developed by the SCM Business Team (subsequently referred to as "SBT"). This team researched various six sigma approaches of selected global companies and then tailored its learning to the SCM domain. The second element of SCM six sigma is some key design principles derived from the team's SCM experience base to guide the implementation of the methodology throughout its different stages.

3.1 Research and tailoring

SBT researched six sigma approaches at General Electric (GE), since GE is a recognized global leader in six sigma. Additionally, the team researched two other companies – DuPont and Honeywell – to get perspectives on how other companies have innovatively applied six sigma to similar needs:

- *General Electric* – A key element of GE's approach to six sigma is the tailoring of underlying methodologies to specific needs and characteristics of its business units. SBT researched GE business that has taken the generic six sigma methodology for process innovation (PI), and has tailored them to specific needs of system design and implementation, and product development activities. Particularly, DMADV (define, measure, analyze, design, and verify) by GE Medical System is an attempt to include process management and process redesign in six sigma, while moving beyond DMAIC (often regarded as a synonym of six sigma), originally developed for high-quality product developments (Hammer, 2002). GE Capital's DABTL (define, architect, build, test, launch) is a six sigma approach designed for systems development.
- *DuPont* – DuPont had just been selected as the 2006 Six Sigma Company by the International Society of Six Sigma Professionals (ISSSP) (Forloines, 2005). Additionally, DuPont also combined six sigma principles with the SCOR (Supply Chain Operations Reference) model, which is a process reference model for SCM developed by the Supply Chain Council and enables effective communication among SCM partners. SCOR scopes five core management processes, including plan, source, make, deliver, and return (See SCOR Model 7.0 for details). The use of SCOR for analyzing supply chains has been of interest (Burgess and Singh, 2006). DuPont's Six Sigma approach utilizes a quality function deployment (QFD) tool, a method or technique for converting customers' requirements to products, processes or services.
- *Honeywell* – Honeywell was selected because of its extensive application of lean methodologies, which has become a major tool in the implementation of six sigma, as evidenced by the Proceedings of the ISSSP (2005). Honeywell developed a proprietary Six Sigma approach called Six Sigma Plus (DMAIC) which links lean manufacturing concepts and tools (e.g. value stream map, thought process map) into a general six sigma.

Each of the above approaches was analyzed and the following conclusions drawn, which fed into the subsequent development of the Samsung SCM six sigma methodology:

- *Nature of SCM projects may involve either design or improvement* – Six sigma projects usually focus on either redesigning processes and systems or improving performance levels of existing systems. In six sigma parlance, the former is addressed most commonly through DMADOV (define, measure, analyze, design, optimize, verify), while the latter is addressed using DMAIC (define, measure, analyze, improve, control). SBT estimated that among the SCM projects at Samsung, about 75 percent would involve re-designing processes, while the remaining 25 percent would focus on process improvement. Accordingly, extant six sigma approaches were adapted in order to accommodate both redesigning and improving processes. Consistent with the expected mix of projects stated above, this new approach was closer to supporting process redesign, but still incorporated all relevant elements for process improvement.
- *DMADOV is not enough* – The DMADOV methodology, while useful, could not provide the necessary support to execute the entire range of SCM projects at the Samsung Group. DMADOV stems from a product design space while one requirement is to support projects in the supply chain space. The key difference is that after performing analyses, the task for the project team would be not to optimize or design as in DMADOV, but to specify how a suggested improvement would be realized in practice. Therefore, a step, "Enable", in place of Design and Optimize, is introduced to address this activity. This is similar to "Design" in GE Medical's DMADV.
- *System development option* – SCM six sigma projects, in most cases, result in system development. Accordingly, a new approach is needed to cover a process enablement step to support system building activity. However, many SCM innovation projects may call for changes that can be enabled within existing system capabilities. Therefore, it was necessary to consider an approach in which system implementation would be an optional enablement activity. We used DABTL (define, architect, build, test, launch) approach (used by GE Capital for systems development), incorporating proven software engineering discipline to six sigma based SCM methodology.

3.2 DMAEV

The resulting approach is termed DMAEV (define, measure, analyze, enable, and verify) (Figure 1). Additionally, we incorporated the concept of five design parameters (process, operation rule & policy, organization role & responsibility, performance measure, and system), process modeling and value chain map techniques, and SCM related investment value analysis methods.

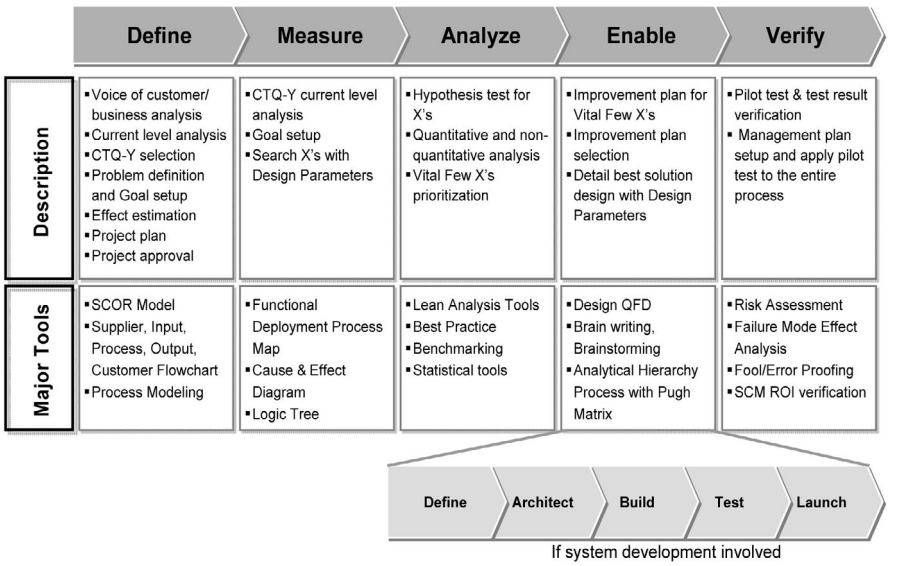
The goal of the Define phase is to define the overall project, including the problem(s) to be tackled, project goal(s) and scope, expected outcomes, and project schedule. The first step identifies key issues and problems through the voice of the customer (VOC) and the voice of the business (VOB) as well as the analysis of SCM related processes. This step elicits customer's critical to quality (CTQ) criteria or characteristics. The next step finds the CTQ-dependent variable (Y). The outcomes from the Define phase become essential for the next phases.

The Measure phase identifies the current level of CTQ-Y, sets up a new target level, and finds the key explanatory variables (Xs). The first step verifies CTQ-Y and then, if necessary, further identifies several specific indicators that can substitute CTQ-Y. The next step measures the current level of CTQ-Y and sets up an improved target level of CTQ-Y. The following step elicits potential Xs (or causes of the problem) with respect to five design parameters:

1 process;
2 operation rule and policy;
3 organizational role and responsibilities;
4 performance measure; and
5 system.

The Analyze phase generates and evaluates "hypotheses" as to the potential Xs. This phase cycles between hypotheses and fact-based analysis to prove or reject the hypotheses. This process involves both quantitative and qualitative analyses for evaluating hypotheses. The quantitative analysis includes various statistical tools such as ANOVA, Pareto analysis and correlation, while the qualitative analysis uses process mapping, cause and effect diagrams and value stream maps. In the end, the goal is to select the vital few Xs, representing a few key explanatory variables.

Figure 1 An overview of SCM six sigma



The Enable phase identifies ways to improve the "as-is" and develops a plan for the "to-be". The quality function deployment (QFD) is used to select the subjects for improvement regarding the vital few *X*s and to elicit detailed action items for improvement. Several alternative solutions are elicited, then the optimal solution is identified through the use of AHP (analytic hierarchy process) methods for improvement or the final to-be plan, which is further detailed in terms of the five design parameters. If system is required as part of the optimal solution, DABTL (design, architecture, build, test, launch) is utilized for systems development and implementation.

The Verify phase establishes a pilot test plan and then validates and verifies the solution chosen in the Enable phase. Next, control and change management plans are developed and then the optimal solution is put into operation. The methodology encourages a comprehensive change management plan that supports the execution of the optimal solution with respect to those five design parameters. The results are continuously collected, monitored, and shared through the Group's repository for projects

Two kinds of measures or KPIs are used:

1 financial; and
2 operational.

In general, the increases in sales, and the decreases in material, inventory and transportation expenses that result from the improvement and redesign of SCM are examples of financial KPIs. Operational KPIs include cycle time, utilization rate, lead time, forecast accuracy, etc.

3.3 Design principles

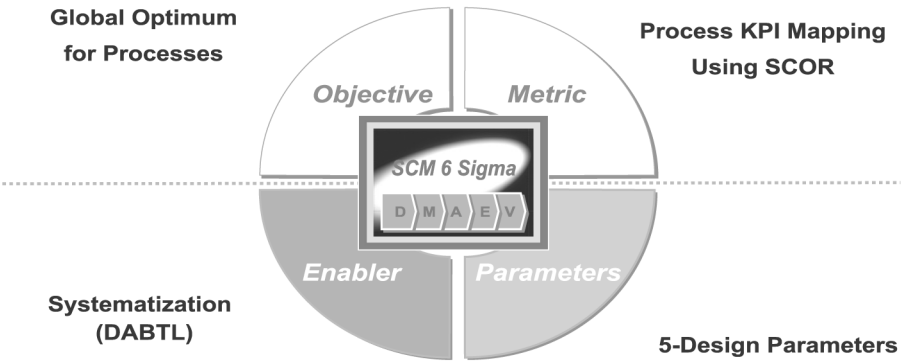
SBT realized that the success of the DMAEV methodology in driving SCM innovation would depend on not only the strength of the methodology itself, but also on relevant business and organizational factors. Based on the SBT team's experience and expertise in business and organizational aspects of SCM, the following design principles that would guide SCM six sigma projects through all of the DMAEV stages were drawn:

- global optimum;
- process KPI mapping;
- systematization; and
- five design parameters (Figure 2).

The overall approach was designed to be easy to learn, apply and maintain. Further, the approach had to be applicable within the regular flow of work of supply chain personnel working on their projects, to avoid them being involved in additional project work:

- *Global optimum* – SCM aix sigma improvements are positioned not as narrowly focused functional improvements but as improvements of the end-to-end SCM process. All improvement ideas must be aligned with global rather than local goals. That is, when improving a process through SCM six sigma, it will be necessary to measure, monitor, and, if possible, improve key performance indicators (KPIs) of related upstream and downstream processes. Thus, two mechanisms for ensuring global optimization were utilized. First, before an improvement is attempted, a flow-down tree of the critical-to-quality KPIs (called CTQ-*Y*), in a hierarchical structure using mega-processes and sub-processes, is used. Later, after the improvement is piloted, a bottom-up check is used to ensure that global KPIs have not been adversely affected.
- *Process KPI mapping* – Process KPIs follow the SCOR Model, and are used to define objectives and monitor the process towards managing improvement plan goals. Compared to generic six sigma, SCM six sigma increases the credibility of CTQ-*Y* selection using KPIs decomposed by detailed supply chain processes of the SCOR model.
- *Systematization* – Systematization is viewed as a key component of an SCM initiative at Samsung. Samsung uses systems (e.g. advanced planning systems) extensively to effect behavioral and process changes. Therefore, to the extent that SCM changes need to be reflected in processes and systems, systematization is a critical component of SCM six sigma. This is achieved utilizing the DABTL

Figure 2 A summary view of Samsung SCM six sigma



(design, analyze, build, test, launch) roadmap for system implementation, which incorporates proven software engineering discipline into our methodology.

- *Five design parameters* – The underlying belief is that any organizational change requires a comprehensive, multi-faceted approach. Thus, DMAEV uses the five design parameters to characterize the changes that need to be managed throughout the DMAEV process stages – process changes; operation rule & policy changes; role & responsibility changes; performance measures/KPI changes; and system and master data changes. A project will need to identify latency cause factors and improvement plans for each of the parameters to ensure comprehensive treatment of root causes.

4. Adoption of SCM six sigma at Samsung

There are two courses in implementing SCM six sigma methodology at Samsung: education ("SCM Six Sigma Black Belt") and application of the methodology in practice.

4.1 SCM Six Sigma Black Belt

The first course is the institutionalization of the methodology at the Group through a four-month training program. The training program, known as SCM Six Sigma Black Belt training and mentoring, consists of one week per month of full-time training for four months, supplemented by mentoring of SCM Black Belts on their selected projects. The prospective SCM BBs have to complete three such projects to get full certification as a SCM Black Belt.

By leveraging the established HR belt system of six sigma, Samsung aims to alleviate the shortage of SCM talent that has been the primary obstacle in improving SCM performance. Samsung expects that SCM six sigma will elevate the effectiveness of its SCM function as people will now understand the overall supply chain process and ways of enabling it. Samsung also expects that greater effectiveness of its people in managing its supply chains will improve the company's ROI. The current training program is within the Group's Six Sigma Academy, the goal of which is to develop talent and future leaders at Samsung. As of today, over 100 SCM Black Belts have been trained.

4.2 An illustrative case

As of 2005/6, SCM projects at Samsung are being conducted by following the SCM six sigma methodology in general and utilizing DMAEV and various data and process analysis techniques in that methodology in particular. To illustrate the application of the SCM six sigma methodology in practice, this section presents a brief overview of a SCM project conducted in a manufacturing firm (its name and detailed information are not revealed). This project, completed in the early 2006, had applied the methodology from its beginning in 2005.

4.2.1 Define

The VOC/VOB analysis began with investigating internal and external business environments and identifying clients of the project. Increases in crude oil price and the devaluation of the Korean won represented a challenging external business environment while an increasing cost associated with surplus inventory was a critical pain point. Top management and various business units including sales, planning & administration, production, purchasing, global operation center (GOC), and transportation in the company were identified as the project's clients. Then, the VOC/VOB was elicited from interviewing those business units (Figure 3).

The next step was to identify problems and inefficiencies in SCM-related business processes, typically encompassing production (e.g. material purchasing, manufacturing), global operation management (e.g. order fulfillment, weekly production plan, inventory management) and sales (e.g. forecasting, order management, sales, transportation). Eight issues were identified, including a lack of visibility in inventory and demand forecasting, in the process of replenishment, weekly production planning and packing & shipping. Drawn from the VOC/VOB and process analysis, two potential CTQs were elicited:

1 demand stabilization; and
2 inventory visibility.

The priority of these two was evaluated with respect to the findings of the VOC/VOB and process analysis. As a result, the latter (development of inventory management process) was chosen as the CTQ and surplus (or unpegged) inventory rate, defined through the formula:

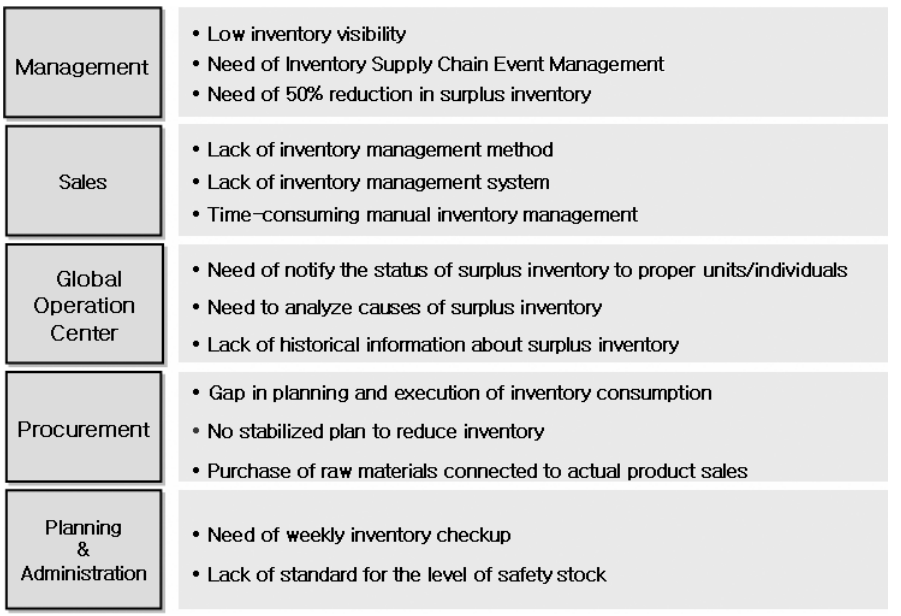
$$\left(\sum \text{Unpegged inventory} / \sum \text{Inventory}\right) \times 100,$$

was selected as CTQ-*Y* (or the key performance indicator of the CTQ).

4.2.2 Measure

The baseline level of surplus inventory rate was measured to be over 10 percent. A new target was set at 6 percent. This required a 42 percent reduction in surplus inventory. Next, potential root

Figure 3 Summary of the VOC and VOB



causes or *X*s were identified in terms of the five design parameters, (process, operation rule & policy, organizational roles and responsibilities, performance measure, and system) and further prioritized using an *X*-*Y* matrix (Table I).

After considering the importance by the project owners, including representatives of the client groups, finally, seven causes associated with three parameters – process, role & policy, and system – were selected as the final *X*s (Table II).

Table I *X*-*Y* matrix

Type of parameter	Potential cause (*X*s)	*X*	Type of *X* *C*	*N*	SOP	Quick win	Evaluation criteria Importance	CTQ Development of inventory management process	Prioritization Total	Percentage rank
Process	Reflecting quick demand	✓						3	3	3
	Inputting weekly demand data	✓						3	3	3
	Recording past surplus inventory	✓						9	9	10
	Planning surplus inventory consumption	✓						9	9	10
	Early detection and advanced managing of surplus inventory	✓						9	9	10
Rule & policy	Standard for demand inputting	✓						3	3	3
	Standard for reflecting quick demand	✓						3	3	3
	Standard for managing excess inventory	✓						9	9	10
	Standard for managing surplus inventory	✓						9	9	10
	Standard for managing safety stock	✓						9	9	10
System	Web user interface design	✓						9	9	10
	Inventory name management	✓						3	3	3
	Amount search capability	✓						1	1	1
Roles and responsibility	New job position for stock management					✓		1	1	1
	Sales and demand control and management					✓		3	3	3
	Rearrangement of stock management tasks					✓		1	1	1
Performance measure	Reduction of demand change rate	✓						3	3	3

Notes: Types of *X*s include *C* (constant variable), *N* (noise), *X* (controllable variable), SOP (standard procedure), and Quick-Fix (variables that can be fixed quickly). Importance: 1 (low impact on *Y*), 3 (medium impact), 9 (high impact)

Table II Selected *X*s

Type	Selected *X*s
Process	Recording past surplus inventory Planning surplus inventory Early detection and advanced managing of surplus inventory
Rule & policy	Standard for managing excess inventory Standard for managing surplus inventory Standard for managing safety stock
System	Web user interface design

4.2.3 Analyze

For those selected *X*s, data collection was planned and executed (Table III). For each question posed in Table III, a detailed data analysis was conducted, including both quantitative (e.g. graph, statistics) and qualitative (e.g. benchmarking, Delphi method, on site visit, document review) tools.

Based on the results of the data analysis, three *X*s – recording past surplus inventory, standard for managing excess inventory, and web user interface design for inventory management – were determined to be the vital few *X*s. These were the factors considered to significantly affect the CTQ-*Y*.

4.2.4 Enable

The three vital few *X*s led to three possible solutions or actions to improve the current SCM. For each solution or action, detailed improvement subjects were elicited with respect to the five parameters. This overall information was constructed through a quality function deployment (QFD) (Figure 4). Then, using benchmarking, the to-be image for each of the three possible solutions was developed. Then, "Web-based user interface design for inventory management" was found to be highly relevant to the overall improvement subjects identified in the QFD. To design and implement the selected optimal solution (named "Web-based early warning system for surplus inventory"), necessary changes were identified with respect to the five parameters. For example, as to the "process" parameter, a list of processes which needed to be improved was identified.

As for the "system" parameter, DABTL was employed to define system requirements and to architect, build, test, and put the web-based system into operation.

4.2.5 Verify

Two stages of pilot test were conducted with a business unit in the company. The first stage, which took place in October 2005, aimed to prove the applicability of newly proposed or improved processes, rules and policies, roles and responsibilities, and performance measure. The pilot test of the system was excluded during this stage. The second stage piloted all improvement subjects associated with the five parameters between 9 January and 28 January 2006. The pilot test resulted in a 37 percent reduction in surplus inventory (CTQ-*Y*), from 10.4 percent to 6.5 percent. Although slightly short of target, the cost associated with surplus inventory decreased from over $2.7 million to $1.9 million.

Next, in order to proceed and accelerate the adoption of the optimal solution, "control" plan and change management plan were developed. The control plan included factors or performance indicators (e.g. inventory consumption rate) to be controlled, methods to control, business unit responsible for each factor, and actions to be taken for unexpected events. The change management considered such elements as critical

Table III Plan and execution of data collection

			Data collection plan	
Selected *X*s	Questions	Analysis tool	Data source	Data collected
Early detection and advanced managing of surplus inventory	Is managing surplus inventory done weekly?	Graph	SAP R/3	January 2004-August 2005 Unpegged inventory, dumped inventory
Recording past surplus inventory	If recording past data of excess, surplus, dumped inventory is done weekly, not monthly, does this have a positive effect on the overall inventory management?	Research on site	Relevant documents	Relevant Excel worksheets
Planning surplus inventory consumption	If managing excess, surplus, dumped inventory is done weekly, not monthly, does this have a positive effect on the overall inventory management?	Research on site	Relevant documents	Relevant Excel worksheets
Standard for managing excess inventory	Is there any standard for managing excess inventory and is it currently used?	Benchmarking	Other companies	Rules and policies of other companies
Standard for managing surplus inventory	Is there any standard for managing surplus inventory and is it currently used?	Benchmarking	Other companies	Rules and policies of other companies
Standard for managing safety stock	Is there any standard for managing safety stock and is it currently used?	Research on site	Inventory monitoring system	Rules and policies for monitoring inventory level of top ten products
Web user interface design	Is web UI used for inventory management?	Benchmarking	Other companies	Other companies' web systems

Figure 4 Quality function deployment

Degree of Relationship : ⊙ High ○ Medium △ Low

	Improvement Subject / Required Improvement	Process			Rule & Policy		Role & Responsibility		Performance Measure			System	
		Inventory search process	Inventory management method	Early warning Process	Early warning standard	Standard for inventory handling	Defining proper individuals for inventory handling	Defining proper units for inventory handling	Managing inventory consumption rate	Measuring inventory level by individuals	Inventory consumption related data entry level	Improvement of excess inventory interface	Improvement of inventory identification interface
1	Recording past surplus inventory	△	○			○	○	△	△				
2	Standard for excess inventory management	△	△			○	△	○	△	○	⊙	△	
3	Web-based system development for inventory management	△	⊙	○	⊙	⊙	△	△	△	△	△	○	○

success factors for system success, communication among various groups, training, ways to resolve potential conflict, and incentive systems. Enterprise-wide deployment is expected by the end of 2006. The plan is to further develop the current web-based warning system to a full-scale supply chain event management (SCEM) system.

5. Conclusion and future direction

Today, there are various approaches and systems available for process innovation. Six sigma and supply chain management (SCM) are among those techniques aiming for process and quality improvement, and synchronization of company's value chain, from inbound logistics to sales and customer services. At Samsung, SCM and six sigma have been two important enablers for the group's management innovation and growth. However, Samsung realize that there is significant room for improvement in its SCM operation. Thus, the effort has been synthesizing SCM and six sigma and developing a unique six-sigma based methodology to improve its SCM operation.

The purpose of this article has been to introduce the company's journey in this course. The methodology has been adopted in two waves since 2005: SCM six sigma Black Belt program and SCM projects. Samsung's effort and investment has turned out to be fruitful. The SCM six sigma Black Belt program has produced highly qualified and talented SCM specialists, who are currently training the methodology to other members in their organizations and leading SCM projects. SCM projects are being prepared and conducted in a more disciplined way and their outcomes are continuously monitored and shared through Samsung's repository for six sigma. Samsung's endeavor for global optimum is continuing and SCM six sigma is expected to play an enabling role.

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